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The magnetic anisotropy of thin epitaxial CrO2 films studied by ferromagnetic resonance

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Abstract

The magnetic anisotropy of thin epitaxial films of chromium dioxide (CrO2) has been studied as a function of the film thickness by the ferromagnetic resonance (FMR) technique. CrO2 films with various thicknesses in the range from 27 to 535 nm have been grown on (100)-oriented TiO2 substrates by chemical vapor deposition using CrO3 as a solid precursor. In a series of CrO2 films grown on the substrates cleaned by etching in a hydrofluoric acid solution, the FMR signal exhibits anisotropy and is strongly dependent on the film thickness. The magnetic properties of CrO2 films are determined by a competition between the magnetocrystalline and magnetoelastic anisotropy energies, the latter being related to elastic tensile stresses caused by the lattice mismatch between the film and the substrate. In the films of minimum thickness (27 nm), this strain-induced anisotropy is predominant and the easy magnetization axis switches from the [001] crystallographic direction (characteristic of the bulk magnet) to the [010] direction.

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